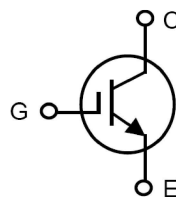


# 1200V XPT™ GenX4™ IGBT

## IXYA20N120C4HV IXYP20N120C4

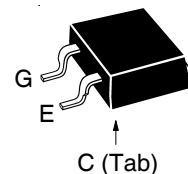
High-Speed IGBT  
for 20-50 kHz Switching



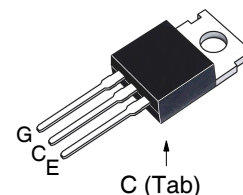
$$\begin{aligned} V_{CES} &= 1200V \\ I_{C110} &= 20A \\ V_{CE(sat)} &\leq 2.5V \\ t_{fi(typ)} &= 58ns \end{aligned}$$

| Symbol                        | Test Conditions                                                                      | Maximum Ratings                                  |            |
|-------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------|------------|
| $V_{CES}$                     | $T_J = 25^\circ C$ to $175^\circ C$                                                  | 1200                                             | V          |
| $V_{CGR}$                     | $T_J = 25^\circ C$ to $175^\circ C$ , $R_{GE} = 1M\Omega$                            | 1200                                             | V          |
| $V_{GES}$                     | Continuous                                                                           | $\pm 20$                                         | V          |
| $V_{GEM}$                     | Transient                                                                            | $\pm 30$                                         | V          |
| $I_{C25}$                     | $T_C = 25^\circ C$                                                                   | 68                                               | A          |
| $I_{C110}$                    | $T_C = 110^\circ C$                                                                  | 20                                               | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms                                                             | 120                                              | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 10\Omega$<br>Clamped Inductive Load | $I_{CM} = 40$<br>$V_{CE} \leq 0.8 \cdot V_{CES}$ | A          |
| $P_C$                         | $T_C = 25^\circ C$                                                                   | 375                                              | W          |
| $T_J$                         |                                                                                      | -55 ... +175                                     | $^\circ C$ |
| $T_{JM}$                      |                                                                                      | 175                                              | $^\circ C$ |
| $T_{stg}$                     |                                                                                      | -55 ... +175                                     | $^\circ C$ |
| $T_L$                         | Maximum Lead Temperature for Soldering                                               | 300                                              | $^\circ C$ |
| $T_{SOLD}$                    | 1.6 mm (0.062in.) from Case for 10s                                                  | 260                                              | $^\circ C$ |
| $M_d$                         | Mounting Torque (TO-220)                                                             | 1.13/10                                          | Nm/lb.in   |
| $F_C$                         | Mounting Force (TO-263HV)                                                            | 10..65 / 22..14.6                                | N/lb       |
| <b>Weight</b>                 | TO-263HV                                                                             | 2.5                                              | g          |
|                               | TO-220                                                                               | 3.0                                              | g          |

TO-263HV  
(IXYA..HV)



TO-220  
(IXYP)



G = Gate      D = Collector  
E = Emitter    Tab = Collector

### Features

- Optimized for 20-50kHz Switching
- Positive Thermal Coefficient of  $V_{ce(sat)}$
- International Standard Packages

### Advantages

- High Power Density
- Low Gate Drive Requirement

### Applications

- Power Inverters
- UPS
- Motor Drives
- SMPS
- Battery Chargers
- Welding Machines
- Lamp Ballasts

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |            |                    |
|---------------|-----------------------------------------------------------------------|-----------------------|------------|--------------------|
|               |                                                                       | Min.                  | Typ.       | Max.               |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 1200                  |            | V                  |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 4.0                   |            | 6.5 V              |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 150^\circ C$             |                       |            | 25 $\mu A$<br>5 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |            | $\pm 100$ nA       |
| $V_{CE(sat)}$ | $I_C = 20A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$          |                       | 2.1<br>2.5 | V<br>V             |

| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) |                                                                                                                                                                  | Characteristic Values |      |                         |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|                                                                                  |                                                                                                                                                                  | Min.                  | Typ. | Max.                    |
| $g_{fs}$                                                                         | $I_C = 20\text{A}, V_{CE} = 10\text{V}$ , Note 1                                                                                                                 | 7.5                   | 12.5 | S                       |
| $C_{ies}$                                                                        | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                       |                       | 890  | pF                      |
| $C_{oes}$                                                                        |                                                                                                                                                                  |                       | 95   | pF                      |
| $C_{res}$                                                                        |                                                                                                                                                                  |                       | 33   | pF                      |
| $Q_{g(on)}$                                                                      | $I_C = 20\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                              |                       | 44   | nC                      |
| $Q_{ge}$                                                                         |                                                                                                                                                                  |                       | 8    | nC                      |
| $Q_{gc}$                                                                         |                                                                                                                                                                  |                       | 20   | nC                      |
| $t_{d(on)}$                                                                      | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 20\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.8 \cdot V_{CES}, R_G = 10\Omega$<br>Note 2  |                       | 14   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                  |                       | 53   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                  |                       | 4.4  | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                  |                       | 160  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                  |                       | 58   | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                  |                       | 1.0  | mJ                      |
| $t_{d(on)}$                                                                      | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = 20\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.8 \cdot V_{CES}, R_G = 10\Omega$<br>Note 2 |                       | 13   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                  |                       | 37   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                  |                       | 4.9  | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                  |                       | 200  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                  |                       | 86   | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                  |                       | 1.6  | mJ                      |
| $R_{thJC}$                                                                       | TO-220                                                                                                                                                           |                       |      | 0.40 $^\circ\text{C/W}$ |
| $R_{thCS}$                                                                       |                                                                                                                                                                  | 0.50                  |      | $^\circ\text{C/W}$      |

## Notes:

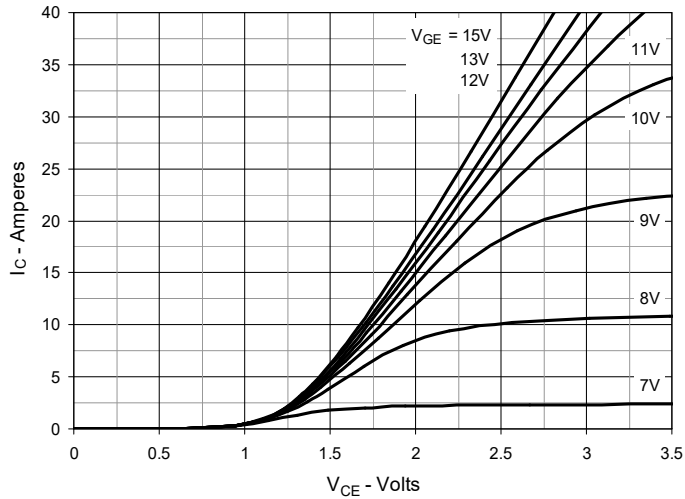
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

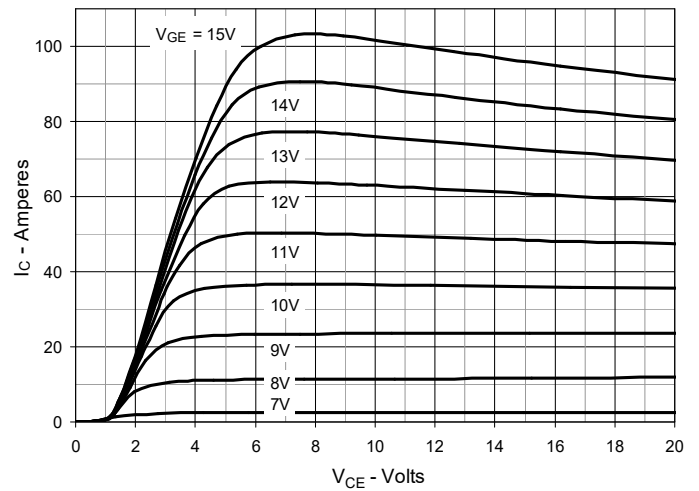
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585    | 7,005,734 B2 | 7,157,338B2 |
| 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692    | 7,063,975 B2 |             |
| 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    | 6,771,478 B2 | 7,071,537    |             |

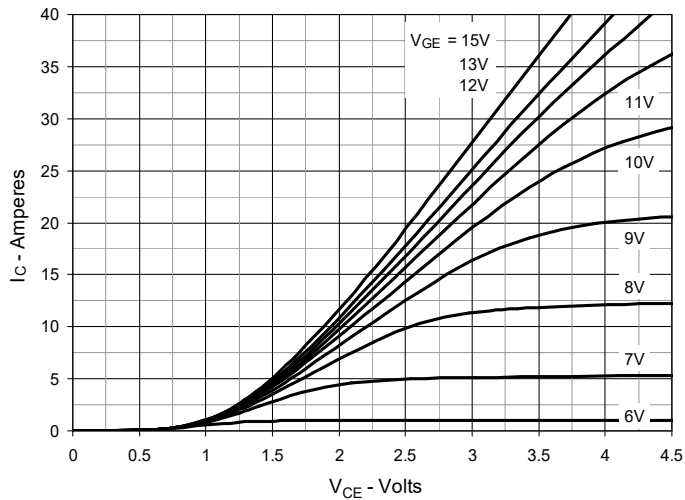
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



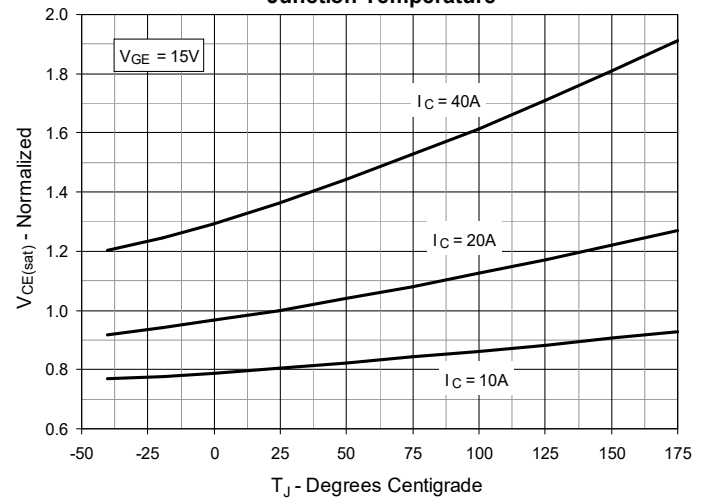
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



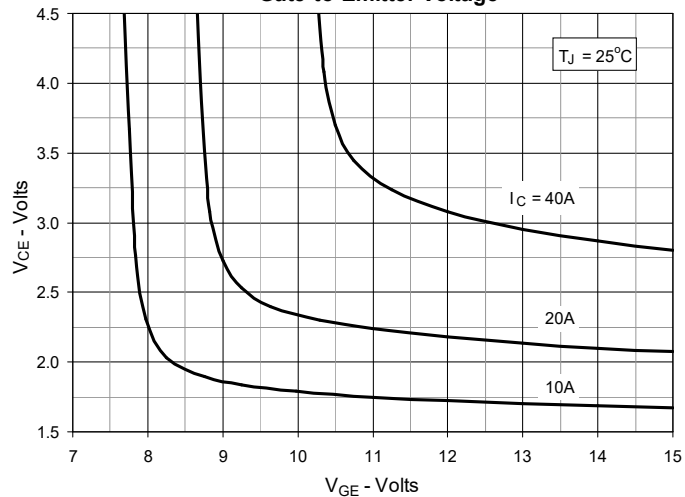
**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$**



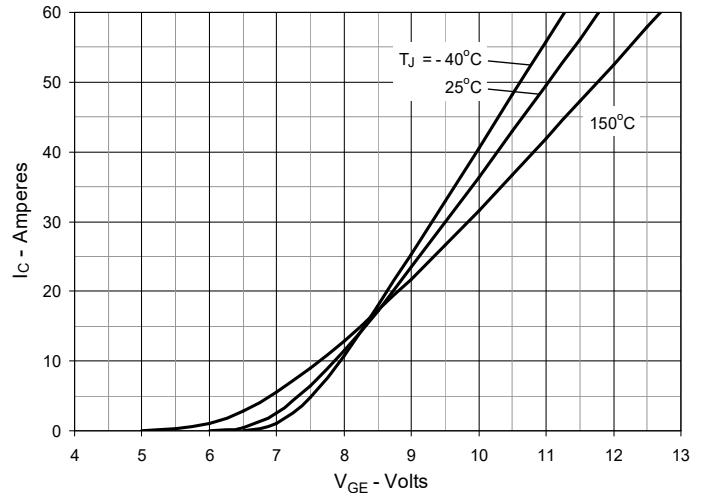
**Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature**



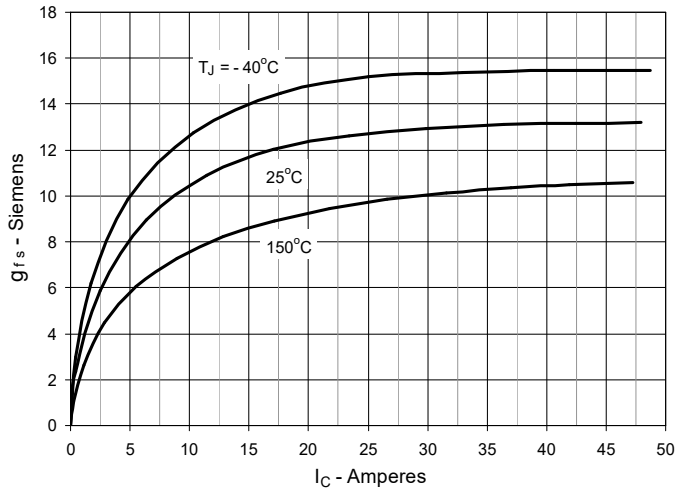
**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**



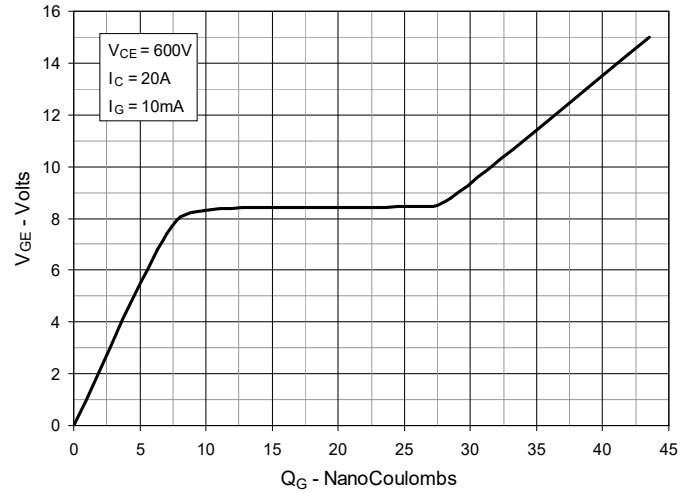
**Fig. 6. Input Admittance**



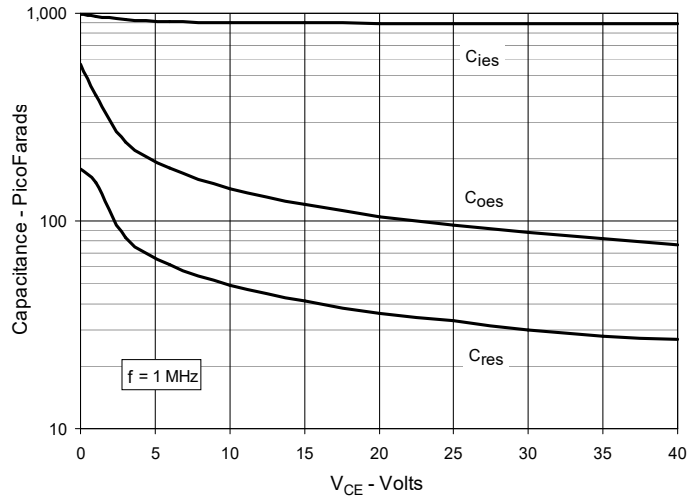
**Fig. 7. Transconductance**



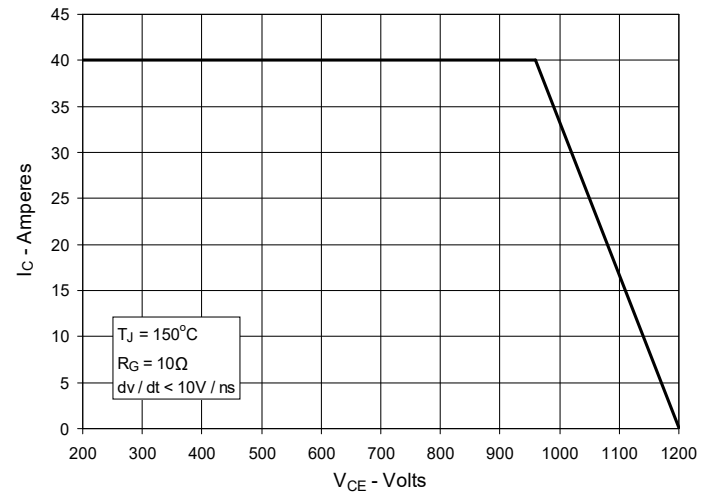
**Fig. 8. Gate Charge**



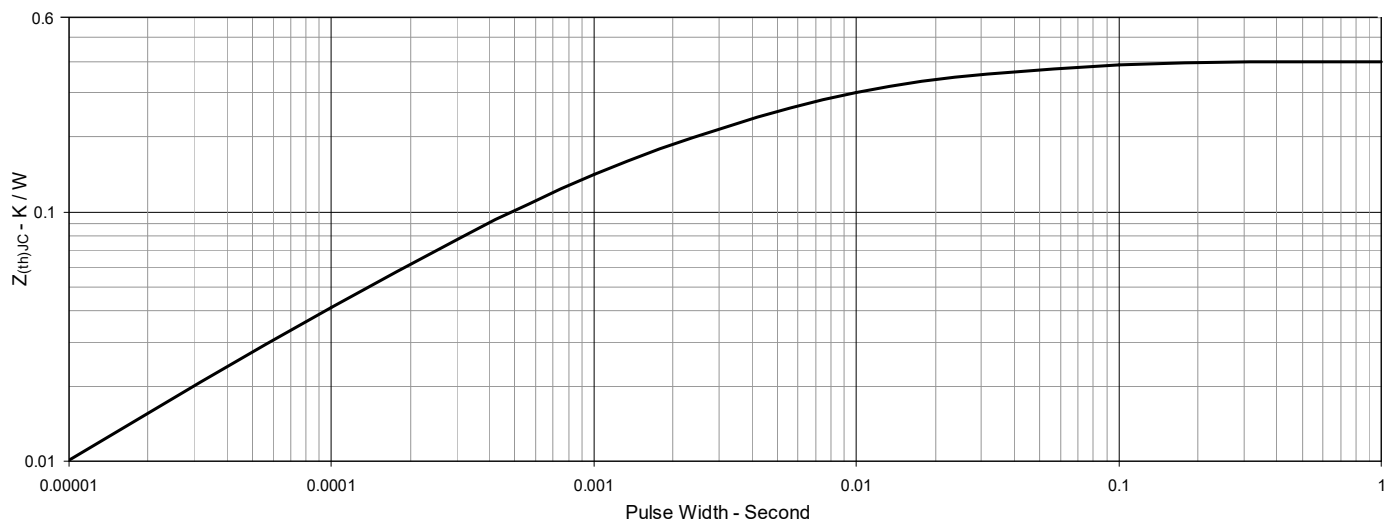
**Fig. 9. Capacitance**



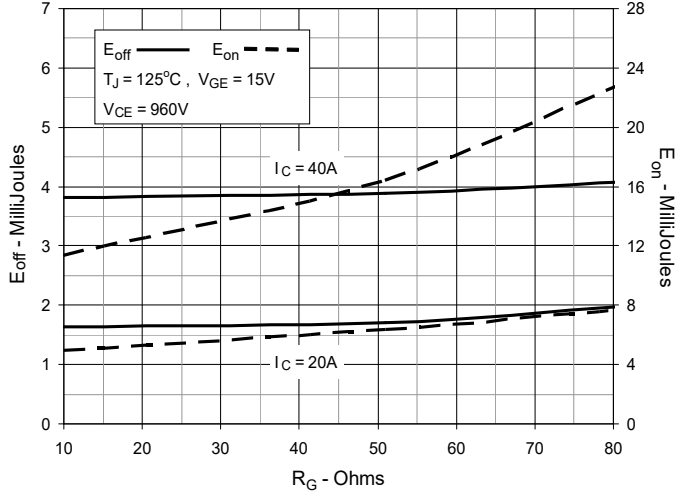
**Fig. 10. Reverse-Bias Safe Operating Area**



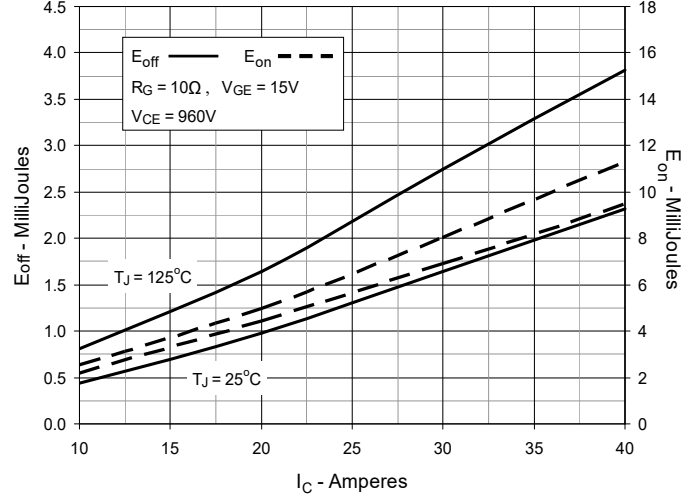
**Fig. 11. Maximum Transient Thermal Impedance**



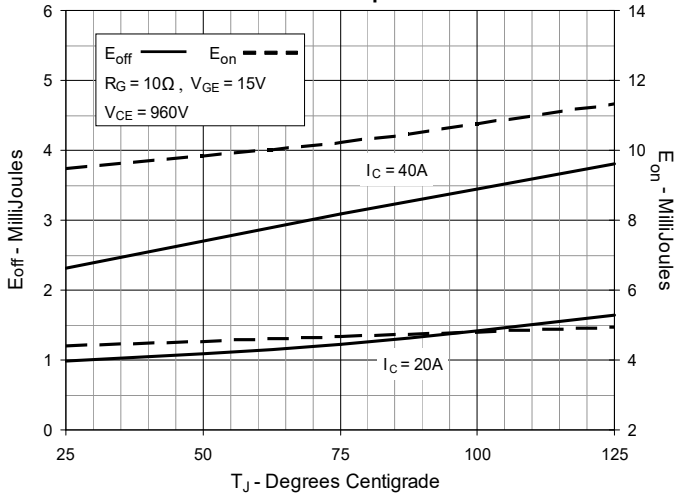
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



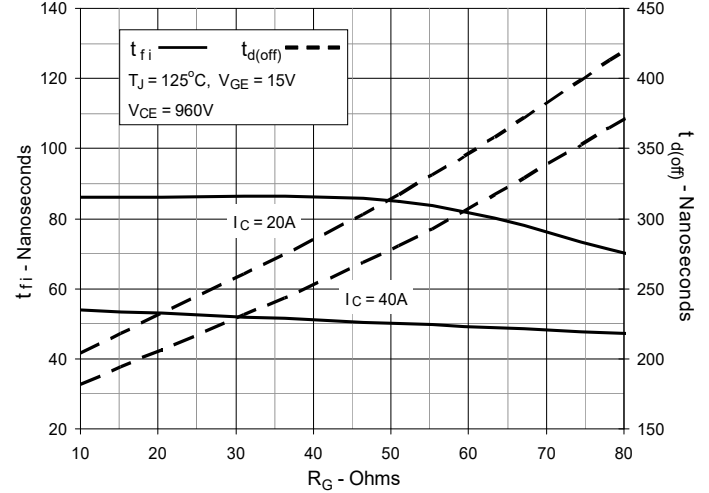
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



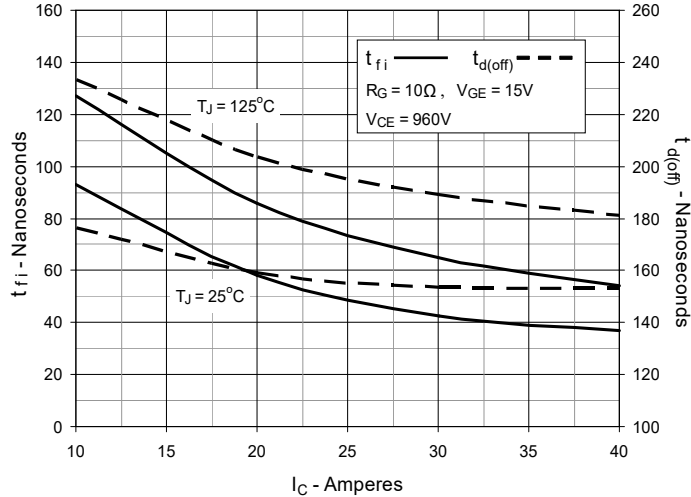
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



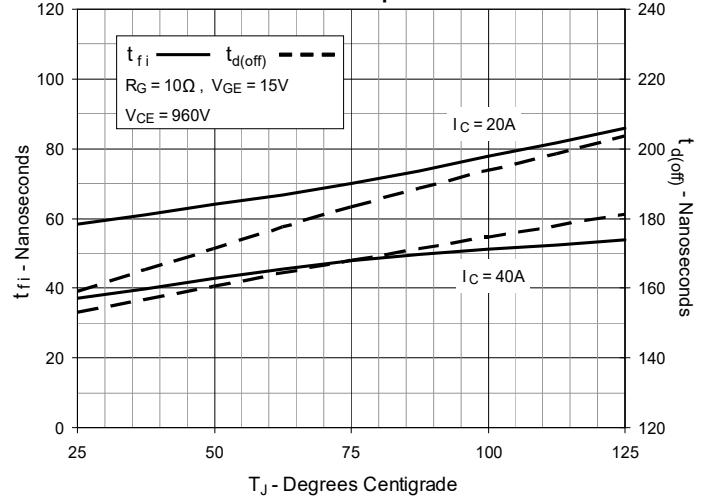
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



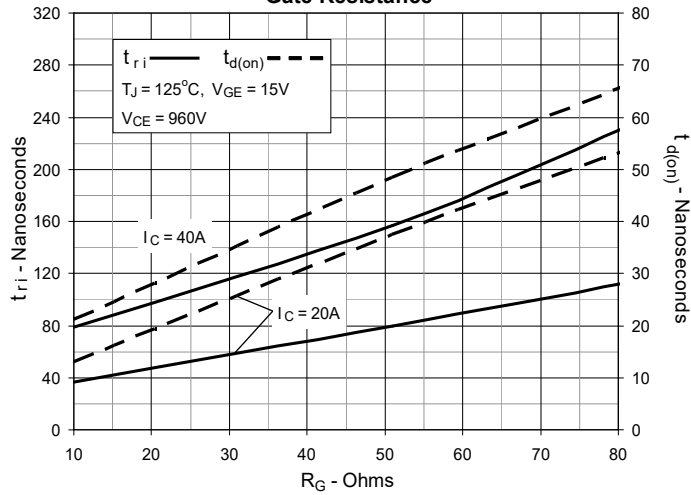
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



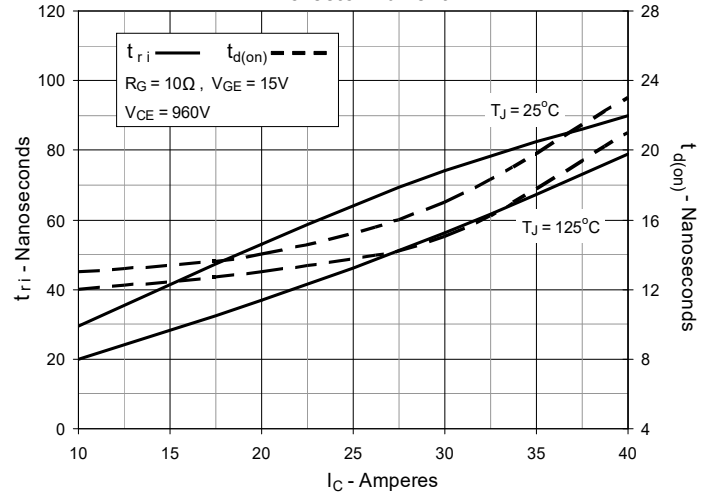
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



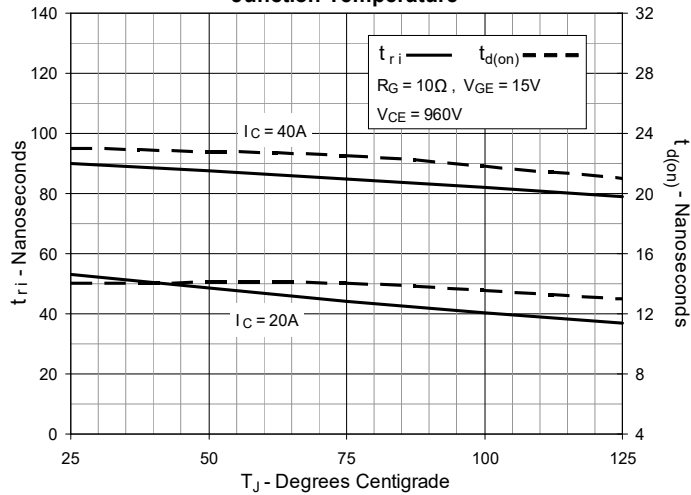
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

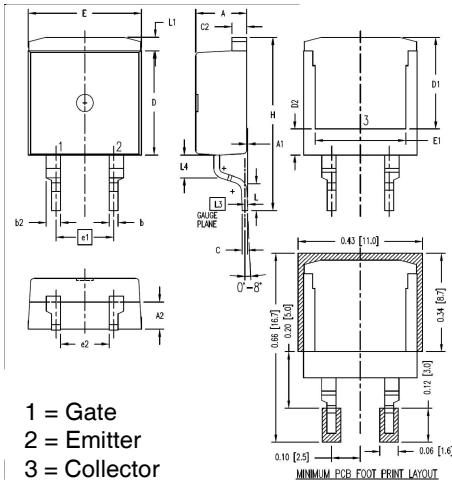


**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

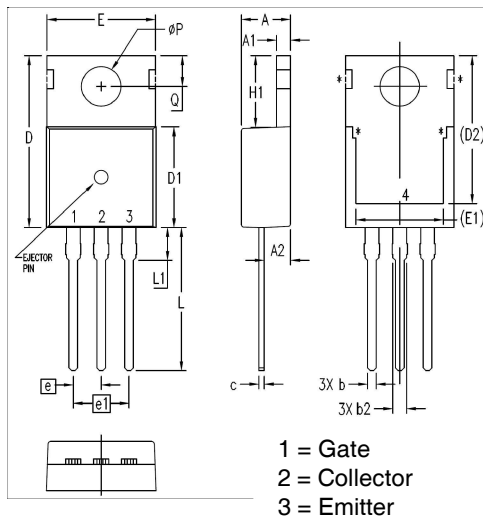


**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**



**TO-263HV Outline**


| SYM  | INCHES |      | MILLIMETER |       |
|------|--------|------|------------|-------|
|      | MIN    | MAX  | MIN        | MAX   |
| A    | .170   | .185 | 4.30       | 4.70  |
| A1   | .000   | .008 | 0.00       | 0.20  |
| A2   | .091   | .098 | 2.30       | 2.50  |
| b    | .028   | .035 | 0.70       | 0.90  |
| b2   | .046   | .054 | 1.18       | 1.38  |
| C    | .018   | .024 | 0.45       | 0.60  |
| C2   | .049   | .055 | 1.25       | 1.40  |
| D    | .354   | .370 | 9.00       | 9.40  |
| D1   | .311   | .327 | 7.90       | 8.30  |
| D2   | .083   | .098 | 2.10       | 2.50  |
| E    | .386   | .402 | 9.80       | 10.20 |
| E1   | .307   | .323 | 7.80       | 8.20  |
| e1   | .200   | BSC  | 5.08       | BSC   |
| (e2) | .163   | .174 | 4.13       | 4.43  |
| H    | .591   | .614 | 15.00      | 15.60 |
| L    | .079   | .102 | 2.00       | 2.60  |
| L1   | .039   | .055 | 1.00       | 1.40  |
| L3   | .010   | BSC  | 0.254      | BSC   |
| (L4) | .071   | .087 | 1.80       | 2.20  |

**TO-220 Outline**


| SYM  | INCHES |      | MILLIMETERS |       |
|------|--------|------|-------------|-------|
|      | MIN    | MAX  | MIN         | MAX   |
| A    | .169   | .185 | 4.30        | 4.70  |
| A1   | .047   | .055 | 1.20        | 1.40  |
| A2   | .079   | .106 | 2.00        | 2.70  |
| b    | .024   | .039 | 0.60        | 1.00  |
| b2   | .045   | .057 | 1.15        | 1.45  |
| c    | .014   | .026 | 0.35        | 0.65  |
| D    | .587   | .626 | 14.90       | 15.90 |
| D1   | .335   | .370 | 8.50        | 9.40  |
| (D2) | .500   | .531 | 12.70       | 13.50 |
| E    | .382   | .406 | 9.70        | 10.30 |
| (E1) | .283   | .323 | 7.20        | 8.20  |
| e    | .100   | BSC  | 2.54        | BSC   |
| e1   | .200   | BSC  | 5.08        | BSC   |
| H1   | .244   | .268 | 6.20        | 6.80  |
| L    | .492   | .547 | 12.50       | 13.90 |
| L1   | .110   | .154 | 2.80        | 3.90  |
| ØP   | .134   | .150 | 3.40        | 3.80  |
| Q    | .106   | .126 | 2.70        | 3.20  |

